#11212

RESTRICTED

Lavoie Laboratories

Matawan - Freehold Road

Morganville 1105 New Jersey

1105

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ULTRA HIGH FREQUENCY WAVEMETER

Model No. 110S

Serial No. 543

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MATAWAN - FREEHOLD ROAD
MORGANVILLE, NEW JERSEY

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Model 110S is a battery-operated, portable wavemeter designed to measure frequencies from 500 to 1000 megacycles. This wavemeter is useful for a variety of measurements on ultra high frequency circuits, as well as for identifying the frequency of ultra high frequency oscillation. The total unit is enclosed in a heavy oak carrying case.

For best results, this wavemeter should be used in a horizontal position. In centering the meter, swing it through resonance several times before coming to rest on the center position.

UHF TUNING RESONATOR The tuning of the resonator is accomplished by varying the capacity in a totally enclosed high "Q" tuned circuit. The tuning inductance is formed by the current paths on the inner side of the resonator. The tuning capacity is the capacity that exists between the movable piston and the cylindrical capacity plate. The capacity is changed by means of the movement of the piston in relationship to the cylindrical condenser. The piston slides in and out of the cylinder by means of a precision screw feed. A strong spring is used to keep the thread of the screw firmly in place, thus preventing backlash introduced by the screw feed. The piston is cut for a high precision fit with the cylinder.

GEAR TRAIN AND DIALS The gear train consists of heavy anti-backlash gears. There are 5,000 equal divisions in the dial system. The drive mechanism is so arranged that for a complete revolution of the counter dial, the number dial makes fifty revolutions. The number dial is numbered successively in equal divisions from zero to one hundred. The counter dial is numbered successively in equal divisions from zero to fifty. The drive mechanism is so arranged as to conveniently tune a sharp signal.

ANTENNA INPUT The input to the wavemeter is terminated at the back of the case by means of a short concentric transmission line. A special fitting designed to take a standard Amphenol connector #93M is used at the end

of the concentric transmission line. A probe is normally inserted in the center terminal of the transmission line; a voltage pickup, by means of this probe, may be used to actuate the wavemeter. If it is desired, a concentric transmission line may be connected to this fitting by means of a standard Amphenol #93M connector. A small probe is used to couple the energy from the transmission line to the tuned circuit of the wavemeter. In order to eliminate undesired currents which might reach the wavemeter by travelling down the outside of the concentric line or by radiation, a knurled nut is used to make a good connection between the terminal of the transmission line and the shielding of the wavemeter. For proper functioning of this instrument, this nut must be securely in place.

UHF DETECTOR An RCA 957 tube is used for the UHF detector. The input to the grid is fed by means of a small probe inserted into the chamber of the wavemeter. The detector is totally enclosed in a shielded compartment to prevent stray voltages from traversing the resonator. This provides a stable mechanical circuit as well as good shielding. The output from the detector is coupled to a low drain amplifier. The grid of the detector is so arranged that it may be switched for modulated or unmodulated signals. For the unmodulated case, the grid is switched directly to the output meter.

AMPLIFIER CIRCUIT The amplifier is a resistance-coupled, high-gain circuit. It has a IS4 in the output and a IS5 as the intermediate amplifying tube. These tubes were chosen because of their low drain and low operating voltages. The output circuit has a copper oxide rectifier for converting the modulation to DC. A 200 microammeter is used for the output indicator. Provision is made for plugging phones into the output for identifying the type of modulation present. The amplifier is very carefully shielded in order to prevent detection on the grids of the amplifying tubes from stray pickup currents.

AC-OPERATED MODELS For AC-operated models, two IS4 tubes are used.

USE OF MODULATED AND UNMODULATED SWITCH A switch is placed on the panel for use of the wavemeter with either a modulated or an unmodulated signal. With the switch turned to the unmodulated position, the wavemeter may be used to measure frequencies that are unmodulated.

In this position, the circuit is through the resonator with detection taking place on the grid of the 957 tube. This rectified current is connected directly to the output meter.

Because of the lack of amplification and sensitivity of the detector at these frequencies, the wavemeter sensitivity will be much less than for a modulated signal. It is recommended, therefore, that for measurements of low signal strength, modulation be produced on the oscillator. The objection to the use of modulation on transmitters is largely because of the frequency swing caused by the change in circuit constants. If the modulation is kept low, this objection will be overcome. When the switch is placed in the modulated position, the circuit then includes the use of the audio amplifier contained in the unit. The diagram of connections, together with the circuit constants, is shown in the appendix.

BATTERIES The plate supply battery is a standard Eveready #482 having a maximum value of 45 volts. The filament supply battery is a standard 1½ volt #742. To change this battery, it is necessary to first remove the knurled nut on the terminal of the transmission line. Six screws, which hold the panel to the case, must be removed. The wavemeter may then be lifted out of the case. For normal operation of intermittent use, the batteries should last at least thirty days.

POWER SUPPLY For AC-operated models, a complete power pact operating on 110 volts replaces batteries.

SHIELDING The shielding difficulties at ultra high frequencies are particularly severe. Good shielding cannot be accomplished in the usual manner. At these frequencies, perfect shielding may only be accomplished by completely soldering all joints. In this wavemeter, the outside of important shields is painted in order to attenuate the ultra high frequency currents that would otherwise flow freely.

UHF COUPLING This wavemeter should be as loosely coupled to the circuit to be measured as is possible in order to obtain good results. Because of inability to secure adequate shielding at the frequencies at which this instrument is to be used, it is necessary to reduce the coupling to prevent spurious responses which might produce erroneous results. Currents picked up by

radiation or other types of coupling may, if of sufficient strength, flow around the tuning resonator and produce detection in any of the amplifying tubes. This type of coupling would be noted in the output as a continuous signal unaffected by the tuning of the resonator except at resonance. Such effects, however, are not particularly severe and will not be encountered if due precautions are taken. If a strong coupling from the wavemeter to the source is used, the effects of a drag loop may be noticed. This is produced by the large "Q" of the resonator and regeneration back from the wavemeter output to the circuit to be measured. Such effects will be noticed by the drag or apparent backlash in the wavemeter. This effect may be decreased by decoupling the wavemeter circuit from the source under investigation.

USES OF THE UHF WAVEMETER There are several uses for which the UHF wavemeter is especially adapted. It may be used as a receiver monitor, as well as for the purpose of identifying the frequency of transmitters. Another important use is the measurement of stability of oscillators under service conditions. The high "Q" of the resonator and the mechanical precision built into this wavemeter makes this instrument capable of identifying slight shifts in frequency. Equipment for the measurement of frequency shift at these frequencies is not generally available and this instrument serves this useful purpose. To identify slight frequency shifts that may be measured, such as the frequency shift that would occur with a variation in plate voltage, use may be made of the list of frequencies for various dial settings.

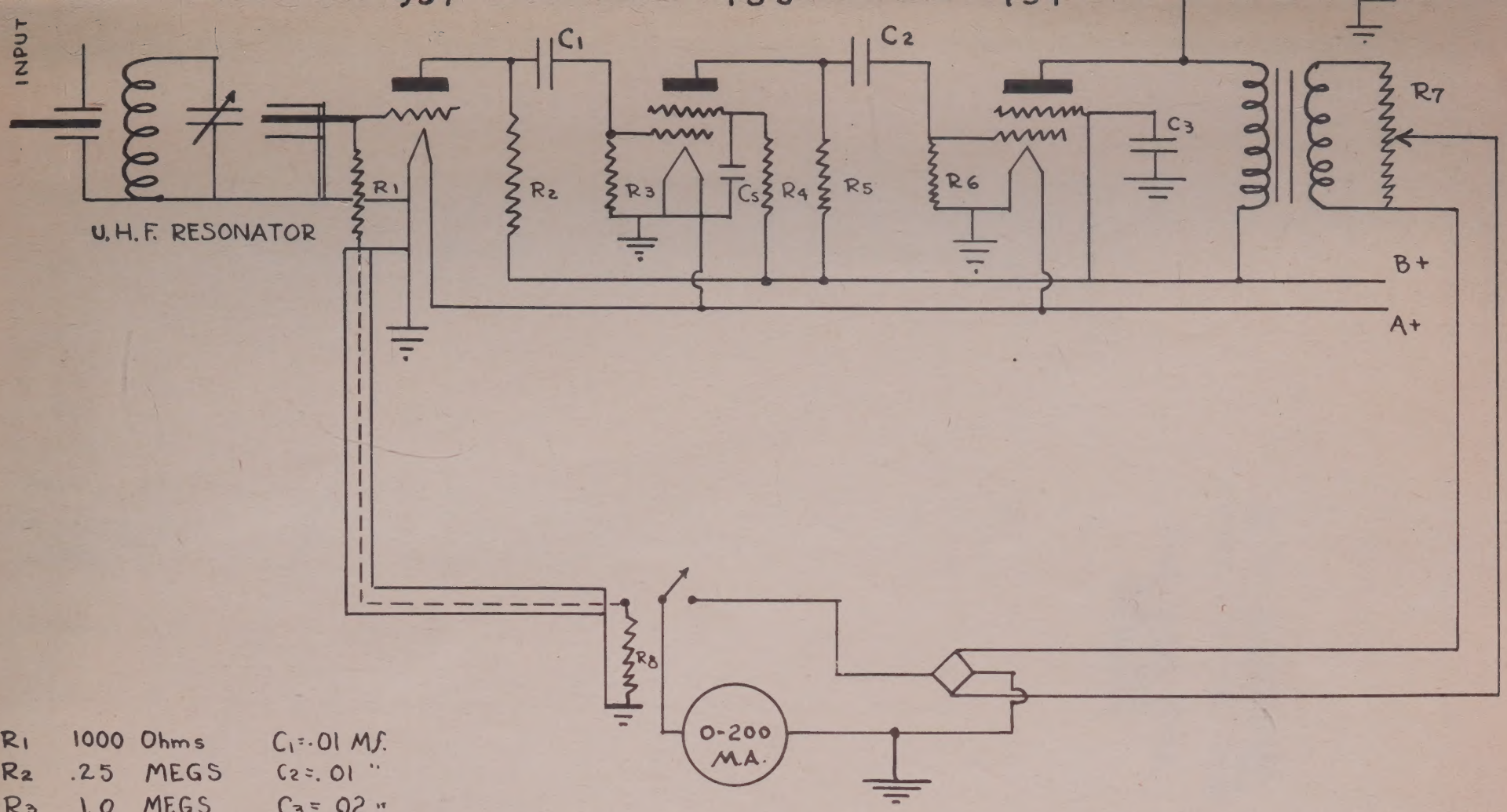
UNPACKING This instrument is shipped with batteries and tubes intact. It may happen that in shipment a tube becomes loosened in its socket. In order to check this condition, it might be well to examine the position of the tubes and their shielding before the instrument is placed in use.

SERVICE DEPARTMENT The life of this wavemeter is indefinite, and operation improves its performance. As the parts wear, friction is reduced and better operation results. A service department is maintained to make calibration checks and replace any parts that may be inoperative from long continuous use.

TEN MEGACYCLE POINTS

MODEL 110S
SERIAL 543

DIAL READING FREQ.	FREQ DIAL READINGS	DIAL READING FREQ.	FREQ DIAL READINGS
000	1012.	2500	747.9
100	1007.9	2600	734.3
200	1003.	2700	721.
300	997.8	2800	708.
400	992.	2900	695.8
500	985.	3000	683.8
600	977.9	3100	671.8
700	969.8	3200	659.8
800	960.5	3300	648.4
900	951.	3400	637.7
1000	941.	3500	627.
1100	929.9	3600	616.3
1200	918.3	3700	606.
1300	906.3	3800	596.
1400	894.3	3900	586.
1500	881.9	4000	576.5
1600	869.	4100	567.3
1700	856.2	4200	558.2
1800	842.7	4300	549.7
1900	829.	4400	541.2
2000	815.5	4500	532.6
2100	801.9	4600	525.
2200	787.8	4700	517.
2300	774.6	4800	509.8
2400	761.4	4900	502.1



R1	1000 Ohms	C_1 = .01 Mf.
R2	.25 MEGS	C_2 = .01 "
R3	1.0 MEGS	C_3 = .02 "
R4	.5 MEGS	C_4 = .05 "
R5	.5 MEGS	C_5 = .02 "
R6	1.0 MEGS	J_1 = OPEN CIRCUIT JACK
R7	50,000 Ohms	
R8	10,000 Ohms	

LAVOIE — LABORATORIES

U.H.F. WAVEMETER - SCHEMATIC

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